Process: Once the print is sanded (sanding first will produce better final results), fully clean the print with a tack cloth. Mix the appropriate ratio of resin to hardener as specified on the instructions for the resin, ensuring everything is measure precisely. Epoxy resins are exothermic when mixed, so glass containers and containers composed of materials with low melting points should be avoided. Containers specifically designed for mixing epoxy resins are recommended. Improper ratios will increase drying time, and the epoxy may never fully cure, resulting in a “tacky” finish. XTC-3D is a specialized coating designed for 3D printing, but any 2-part epoxy resin will work well for this application as long as it is prepared properly. Thoroughly mix the resin and the hardener as per the instructions using smooth revolutions, to minimize the number of air bubbles introduced to the system. A little epoxy goes a long way, and most epoxies only have a working time of 10-15 minutes so plan accordingly.

Apply the first coat of the epoxy using a foam applicator, and try to minimize pooling on any recessed surfaces or details of the print. Once the print has been sufficiently coated, allow the epoxy to fully cure as per manufacturer instructions. A first coat may be sufficient to smooth the print, but for an optimal finish, the print should be lightly sanded with fine sandpaper (1000 grit or higher) to remove any imperfections. Remove any dust with a tack cloth, and apply a second coat of epoxy, following the same procedure.

Pros

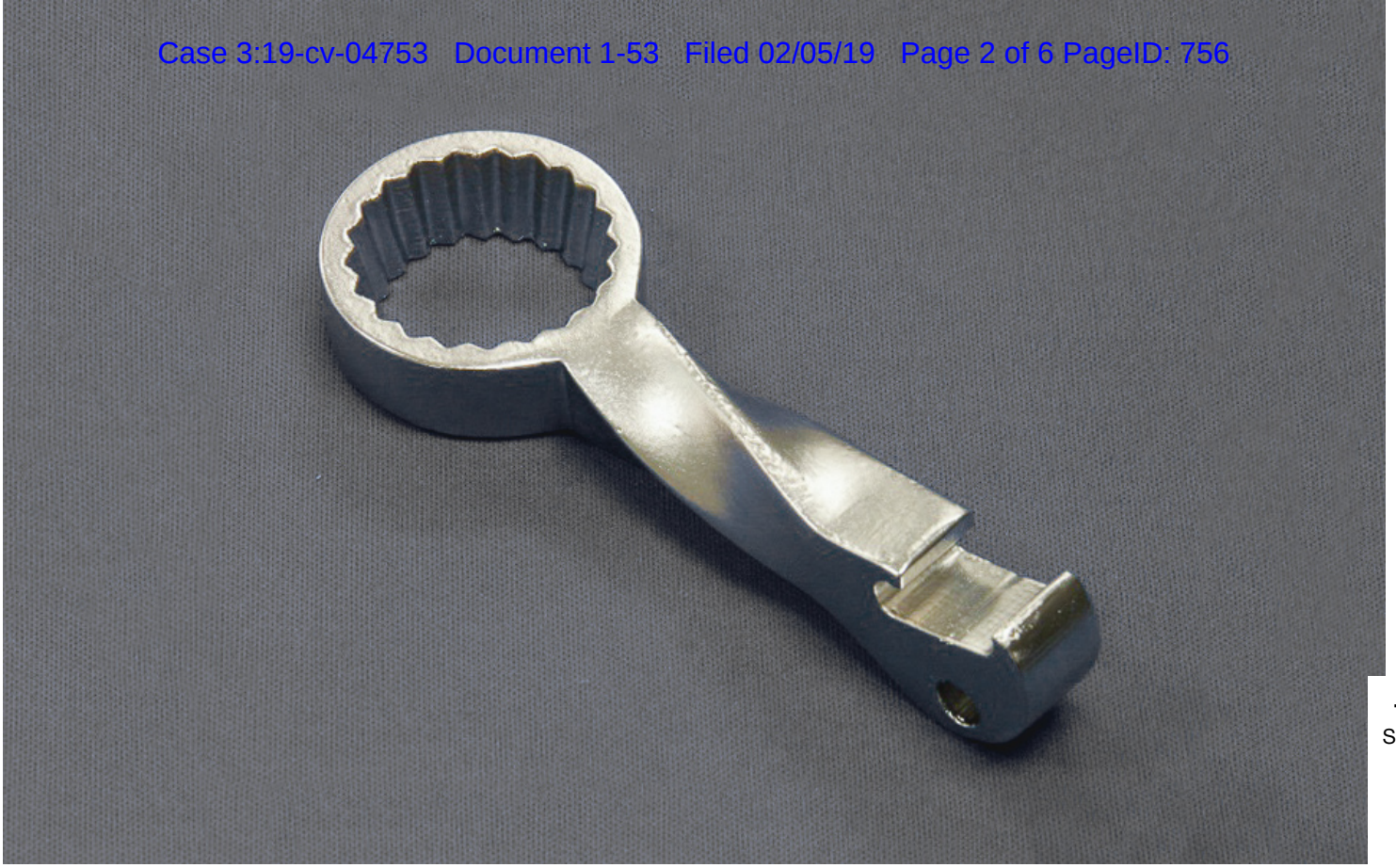
+ Very thin layer of epoxy will not impact the tolerances of the print all that greatly (unless the print is sanded first).
+ Provides an outer protective “shell” around the print.

Cons

– Surface layer lines will still be visible, they are just under a “smooth” shell.
– Applying too much epoxy can result in pooling in details of the print and edges, giving the surface a “dripping” look.

Finish	★★★★☆
Tolerances	★☆☆☆☆
Speed	★★★★☆
Suitable for	All FDM thermoplastics

Metal plating



A nickel plated, FDM printed structural member coated by Repliform using RepliKote Technology.

Tool kit (for home plating)

- Electroforming solution - Electroforming solution can be made by mixing a metal salt with an acid and water, but unless the measurements are exact and the ingredient quality is very high, it is difficult to achieve professional finishes. Buying a premade solution (such as Midas' solutions) will ensure plating issues are not due to the solution.
- Sacrificial anode - The material of the anode must match the metal of the electroforming solution, so if copper sulfate is used in the solution, then a copper anode must be used. Any object made of the plating metal can be used (such as copper wire for copper plating), or a thin strip of the plating metal can be purchased, which is made specifically for electroplating.
- Conductive paint or acetone & graphite - The surface of the print must be conductive for plating to work, which can be achieved with conductive paint or a 1:1 solution of graphite and acetone. The conductive paint will work for any print material, but the acetone graphite solution will only work for ABS.
- Power rectifier - A battery can be used in place of a power rectifier, but a battery is not as efficient and will not produce results as quickly or consistently as a rectifier will. A rectifier is also a safer option, as it can simply be turned off to break the current flow during electroplating.
- Conductive screw or eye-hook
- Non-conductive vessel

- Lead set
- Non-conductive gloves and protective eyewear - Electroforming solutions are acidic, and can cause eye damage if splashed, so appropriate eyewear is necessary. It can also irritate skin and will conduct charge during electroplating, therefore non-conductive gloves should be used at all times.

Process: Metal-plating can be done using electroplating at home, or a professional shop. Proper metal-plating requires a strong knowledge of materials, and what can be done at home is limited in comparison to what a professional shop can achieve. For superior finishes, and a wider range of plating options including chroming, utilizing a professional shop is the best option. For clarity, the process of electroplating with copper will be described below.

Electroplating at home can be done using copper or nickel as a base plate, to which other metals can then be plated over. It is of critical importance that the print surface is as smooth as possible prior to plating; any irregularities and layer lines will be emphasized after the plating process. Prepare the cleaned and sanded print for plating by coating the plastic with a thin layer of high-quality conductive paint, or a solution of acetone and graphite if the print is ABS. Allow the conductive coating to dry fully, and sand if necessary to ensure a smooth surface. It is of utmost importance to minimize contact with the print at this point or wear gloves, as the oils from skin will affect the plating process.

Insert the screw or eyehook into an inconspicuous surface of the print, and attach to one of the rectifier leads; this will serve as the cathode and must be connected to the negative terminal of the rectifier. Attach the copper anode to the positive terminal of the rectifier using the second power lead, and fill the chosen vessel with enough copper electroforming solution to fully cover the print and copper anode. Insert the anode into the bath and turn on the power rectifier. Once the rectifier is on, insert the print into the bath, ensuring it is not contacting the anode at any point **(Be very careful at this step, as once the print is in the bath, the plating system is electrically live and any contact with the solution or anode/cathode can cause injury).** Set the power rectifier to 1-3 volts, and allow plating to occur until the print is fully coated. The voltage can be increased to increase plating time, but do not exceed 5 volts. Simply power off the rectifier and remove the print once a satisfactory coating has been deposited and dry the print using microfiber towels. Coat the print with a metal lacquer once dry to protect from corrosion.

Pros

+ A plated metal shell increases the strength of the plastic part, which greatly broadens potential applications and uses of the print.
+ The outer metal coating is very thin, so tolerances can be tightly held if the plating is done properly.
+ Produces a beautiful surface finish, which if done properly, will not look like a 3D printed ob

Cons

- Generally, very expensive to plate the prints professionally, and electro-plating at home requires a decent amount of equipment for a professional finish.
- Electroplating at home can cause electrical injury if proper safety procedures are not followed and adhered to.

Finish	★★★★☆
Tolerances	★★★☆☆
Speed	★★★★☆
Suitable for	All FDM thermoplastics

About 3D Hubs

Written by

Courtney Armstrong

Enza3D's Hub - Enza3D is located on Long Island, and provides printing service for the greater metropolitan area. The Hub prints in a variety of filament, but specializes in exotic filament for FDM printing and SLA printing. Enza is home to mechanical engineers, and happily provides engineering consulting services in addition to 3D printing.

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